

Claims

[c1]

What is claimed is:

1. A liquid crystal display (LCD) comprising:

a first substrate comprising a first surface;

a second substrate comprising a second surface, the second surface being in parallel with and opposite to the first surface of the first substrate, and a pixel area being defined on the second surface;

a first electrode positioned on the first surface of the first substrate;

a second electrode disposed above the pixel region of the second substrate, the second electrode having a first slit elongated along a first direction;

an isolation layer disposed on the surface of the second substrate to cover the second electrode;

a third electrode disposed on the isolation layer and within the pixel region, a second slit being defined on the third electrode and along the first direction, the first and second slits being interlaced; and

a plurality of anisotropic liquid crystal molecules with negative dielectric constant positioned between the first electrode and the third electrode, the longitudinal axis of the liquid crystal molecules being positioned along a second direction horizontally, and a first angle being formed between the first direction and the second direction;

wherein a biased electric field is formed as a voltage is applied between the first electrode and the second electrode,

such that (a) a first horizontal biased electric field is formed in the neighborhood of the second slit, the first horizontal biased electric field is perpendicular to the first direction, and the liquid crystal molecules are rotated to make the longitudinal axis of the liquid crystal molecules in the neighborhood of the second slit being in parallel to the first direction,

(b) the longitudinal axis of the liquid crystal molecules in the neighborhood of the first electrode maintain along the second direction because no horizontal biased electrical field is formed near the first electrode, and

(c) the liquid crystal molecules between the first electrode and the second slit of the third electrode gradually rotate from the second direction to the first direction.

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[c2] 2. The liquid crystal display of claim 1, further comprising a first polarizer positioned above the first substrate, and a second polarizer positioned below the second substrate.

[c3] 3. The liquid crystal display of claim 1 wherein the second electrode is a transparent pixel electrode.

[c4] 4. The liquid crystal display of claim 1 wherein the third electrode is a transparent lower common electrode.

[c5] 5. The liquid crystal display of claim 1 wherein the biased electric field formed between the second electrode and the third electrode is used to accelerate the rotation of the liquid crystal molecules so as to reduce a driving voltage of the liquid crystal display.

[c6] 6. The liquid crystal display of claim 1 wherein the isolation layer is used to isolate the second electrode from the third electrode and avoid a short circuit between the second electrode and the third electrode.

[c7] 7. The liquid crystal display of claim 1 further comprising a protrusion projected from the first surface of the first substrate, the protrusion being electrically connecting the first electrode with the third electrode so that the first electrode and the third electrode being in a substantially equal voltage.

[c8] 8. The liquid crystal display of claim 7 wherein a common signal is provided to the first and third electrodes, the first electrode is connected to the third electrode so as to reduce a delay of the common signal.

[c9] 9. The liquid crystal display of claim 7 wherein the third electrode has a width, and the width is reduced when the first electrode is connected to the third electrode so as to increase an aperture ratio of the display.

[c10] 10. The liquid crystal display of claim 7 wherein static charges formed on the first electrode are released through the protrusion after the first electrode is connected to the third electrode.

[c11] 11. The liquid crystal display of claim 7 wherein the distance between the first

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Fig 1

and second substrate is defined as a cell gap, and the protrusion is used to form an even cell gap between the first and second substrates.

Fig. 1. Schematic diagram of the cell gap formation process.